

**A SURFACE-TO-BEDROCK, SHEAR WAVE AND GEOTECHNICAL
INVESTIGATION OF THE POST-PALEOZOIC SEDIMENTS ACROSS THE UPPER
MISSISSIPPI EMBAYMENT BETWEEN THE 35TH AND 36TH PARALLELS:
COLLABORATIVE WITH THE UNIVERSITY OF MEMPHIS**

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Ron Street and Edward Woolery

**University of Kentucky
Kentucky Geological Survey
228 Mining and Mineral Resources Building
Lexington, KY 40506-0107**

FAX: 859-257-1147

**E-mail Address: ewoolery@kgs.mm.uky.edu
<http://www.uky.edu/KGS/>**

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INVESTIGATIONS UNDERTAKEN

The objective of the study is to determine the shear-wave velocities of the post-Paleozoic sediments at a representative set of sites along an east-west profile across the Upper Mississippi Embayment between 35¼° and 35½°N latitude. Figure 1 shows the location of the sites where data are being acquired in the study. Shear-wave velocities at the sites are being derived through the use of P-wave reflection soundings (to the top of the bedrock), SH-wave reversed refraction/reflection profiling for near-surface (depths < 150 m) S-wave velocities, long-offset SH-wave Vibroseis soundings, and travel-time differences between the *S* and *Sp* phases of regional earthquakes recorded at seismograph stations in the study area. The seismic soundings are also correlated to drill hole information where available.

RESULTS

To date we have acquired seismic reflection and refraction data at 57 sites across the embayment area (Figure 1). P-wave soundings have been completed at all of the sites, and reversed, near-surface (< 150 m), SH-wave profiles have been acquired at most of the sites. The seismic

data has been processed, and is being collated with available drill hole data, as well as $S_p - S$ travel-time differences from seismograph stations in the area.

We have also recorded three-component, short-period (< 2 s) ambient noise at several of the sites in the Arkansas part of the study area. The objective of the ambient noise recordings was to determine if pertinent site effect information could be obtained from short-period noise. While this aspect of the study has been disappointing, we have been able to demonstrate a close correlation between the horizontal-to-vertical spectral ratio of the short-period ambient noise at a site, and the near-surface velocity model (Woolery and Street, 2001).

NONTECHNICAL SUMMARY

The objective of this study is to derive well-constrained shear-wave velocities of the sediments across the Upper Mississippi Embayment between the latitudes of $35\frac{1}{4}^{\circ}$ and $35\frac{1}{2}^{\circ}$ N. The thickness of the sediments varies from a few meters near the edges of the embayment, to several hundreds of meters near the center. These sediments are expected to have a profound influence on the ground motions in the area as a result of a damaging earthquake in the New Madrid seismic zone. An accurate characterization of the sediment's shear-wave velocity profile can better assist researchers better predict the hazard posed by earthquakes, as well as to recommend mitigation strategies.

PUBLICATIONS

Woolery, E., and R. Street (2001). 3D near-surface soil response of earthquake engineering interest from H/V ambient noise ratios. *Expanded Abstracts*, Tenth International Conference on Soil Dynamics and Earthquake Engineering (SDEE2001), October 7-10, Philadelphia, Pennsylvania.

Woolery, E., and R. Street (in review). 3D near-surface soil response from H/V ambient noise ratios. *Journal of Soil Dynamics and Earthquake Engineering*.

AVAILABILITY OF DATA

P- and SH-wave seismic reflection and refraction data acquired in the study are being organized by site, and will be stored at the Kentucky Geological Survey as field and processed files. Along with the data files for each site, there will be information as to the location of the site, recording parameters, and other pertinent information. The seismic data will be stored in standard SEG format at the completion of the study, and available upon request. Requests for information should be directed to:

**Dr. Edward Woolery
Kentucky Geological Survey
228 Mining and Mineral Resources Building
University of Kentucky
Lexington, KY 40506-0107
Telephone: 859-257-5500
FAX: 859-257-1147
Email: ewoolery@kgs.mm.uky.edu**